This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{169}{0}} + \sqrt{60}i$$

The solution is Not a Complex Number, which is option B.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Not a Complex Number

* This is the correct option!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$8 - 1 \div 20 * 5 - (4 * 13)$$

The solution is -44.250, which is option D.

A. $[59.76, 60.65]$

59.990, which corresponds to not distributing addition and subtraction correctly.

B. $[48.71, 49.16]$

48.750, which corresponds to not distributing a negative correctly.

C. $[-44.2, -43.15]$

-44.010, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-44.61, -44.11]$

* -44.250, which is the correct option.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 - 2i)(8 - 9i)$$

The solution is $-66 + 38i$, which is option A.

A. $a \in [-70, -63]$ and $b \in [38, 47]$

* $-66 + 38i$, which is the correct option.

B. $a \in [-51, -47]$ and $b \in [17, 20]$

$-48 + 18i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-33, -26]$ and $b \in [-77, -66]$

$-30 - 70i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-70, -63]$ and $b \in [-43, -36]$

$-66 - 38i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-33, -26]$ and $b \in [68, 77]$

$-30 + 70i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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4. Simplify the expression below and choose the interval the simplification is contained within.

$$15 - 11^2 + 3 \div 10 * 7 \div 12$$

The solution is -105.825, which is option B.

A. $[135.9, 136.06]$

136.004, which corresponds to two Order of Operations errors.

B. $[-105.89, -105.76]$

* -105.825, this is the correct option

C. $[-106.13, -105.98]$

-105.996, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[136.12, 136.33]$

136.175, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{484}} + \sqrt{10}i$$

The solution is Pure Imaginary, which is option E.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

D. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

E. Pure Imaginary

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 + 33i}{8 - 5i}$$

The solution is $3.81 + 6.51i$, which is option B.

A. $a \in [7.45, 7.55]$ and $b \in [-1, 0]$

$7.52 - 0.57i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [3.7, 4.4]$ and $b \in [5.5, 7.5]$

* $3.81 + 6.51i$, which is the correct option.

C. $a \in [3.7, 4.4]$ and $b \in [578.5, 580.5]$

$3.81 + 579.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [7.85, 7.95]$ and $b \in [-7, -6]$

$7.88 - 6.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [338.9, 339.05]$ and $b \in [5.5, 7.5]$

$339.00 + 6.51i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(2 - 5i)(-9 + 3i)$$

The solution is $-3 + 51i$, which is option D.

A. $a \in [-5, 4]$ and $b \in [-56, -44]$

$-3 - 51i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-22, -15]$ and $b \in [-17, -13]$

$-18 - 15i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-35, -31]$ and $b \in [38, 47]$

$-33 + 39i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-5, 4]$ and $b \in [49, 52]$

* $-3 + 51i$, which is the correct option.

E. $a \in [-35, -31]$ and $b \in [-46, -31]$

$-33 - 39i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{15}{0}}$$

The solution is Not a Real number, which is option A.

A. Not a Real number

* This is the correct option!

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{15}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-54 + 88i}{7 + 5i}$$

The solution is $0.84 + 11.97i$, which is option E.

A. $a \in [0, 1]$ and $b \in [884.5, 886.5]$

$0.84 + 886.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-9, -7]$ and $b \in [16.5, 18]$

$-7.71 + 17.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-12, -10.5]$ and $b \in [4, 6]$

$-11.05 + 4.68i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [60.5, 63]$ and $b \in [11, 13]$

$62.00 + 11.97i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [0, 1]$ and $b \in [11, 13]$

* $0.84 + 11.97i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{1760}{10}}$$

The solution is Irrational, which is option C.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Irrational

* This is the correct option!

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{176}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
